

## CLAIMS

What is claimed is:

- 1           1.     A method for receiving a differential M-ary signal having one or more  
2     hopped features in a multiuser communication system, the method comprising:  
3           receiving a co-channel signal including a target-user differential M-ary signal and  
4           one or more interfering other-user differential M-ary signals;  
5           detecting at least one hopped feature per a predetermined time interval of the co-  
6           channel signal;  
7           constructing a trellis model for each user using detected hopped feature values as  
8           nodes; and  
9           determining soft-decision estimates of data bits included in the co-channel signal  
10          for each user, using the corresponding trellis model.
- 1           2.     The method of claim 1 wherein the hopped feature is at least one of  
2     frequency, time, phase, amplitude, code, duty cycle, polarity, dwell time, and basis  
3     function.
- 1           3.     The method of claim 1 further comprising:  
2           removing estimated contributions of the interfering other-user differential M-ary  
3           signals using multiuser detection (MUD), thereby providing an interference-  
4           cancelled signal; and  
5           re-decoding ambiguous data estimates remaining in the interference-cancelled  
6           signal
- 1           4.     The method of claim 3 further comprising:  
2           in response to determining iteration is likely to improve the quality of the re-  
3           decoded data estimates, repeating the removing and re-decoding; and  
4           in response to determining iteration is not likely to improve the quality of the re-  
5           decoded data estimates, providing the re-decoded data estimates as final  
6           decoded data.

- 1           5.       The method of claim 3 further comprising:  
2       repeating the removing and re-decoding one or more times.
- 1           6.       The method of claim 3 further comprising:  
2       providing the re-decoded data estimates as final decoded data.
- 1           7.       The method of claim 1 further comprising:  
2       providing the soft-decision estimates as final decoded data.
- 1           8.       The method of claim 1 wherein determining the soft-decision estimates  
2       includes generating estimates of the data bits based on a cumulative soft-valued metric.
- 1           9.       The method of claim 1 wherein determining the soft-decision estimates  
2       includes providing a confidence value for each estimate.
- 1           10.      The method of claim 1 wherein further comprising:  
2       inferring missing nodes of the trellis model from existing nodes based on one or  
3               more detected hopped feature values; and  
4       correcting for burst errors.
- 1           11.      A system for receiving in a multiuser communication environment a co-  
2       channel signal including a target-user differential M-ary signal and one or more interfering  
3       other-user differential M-ary signals, the system comprising:  
4               an initial decoding module adapted to detect at least one hopped feature per a  
5               predetermined time interval of the co-channel signal, thereby enabling  
6               construction of a trellis model for each user using detected hop feature  
7               values as nodes, and to determine soft-decision estimates of data bits  
8               included in the co-channel signal for each user, using the corresponding  
9               trellis model; and  
10              an interference cancellation and re-decoding module operatively coupled to the  
11              initial decoding module, and adapted to remove estimated contributions of  
12              the interfering other-user differential M-ary signals using multiuser

13 detection (MUD) thereby providing an interference-cancelled signal, and to  
14 re-decode ambiguous data estimates remaining in the interference-cancelled  
15 signal.

1 12. The system of claim 11 wherein the hopped feature is at least one of  
2 frequency, time, phase, amplitude, code, duty cycle, polarity, dwell time, and basis  
3 function.

1 13. The system of claim 11 wherein the initial decoding module includes:  
2 a hopped feature detector for detecting the at least one hopped feature per a  
3 predetermined time interval of the co-channel signal; and  
4 one or more soft decision trellis decoders for determining the soft-decision  
5 estimates of data bits.

1 14. The system of claim 13 wherein each soft decision trellis decoder is further  
2 adapted to generate estimates of the data bits based on a cumulative soft-valued metric.

1 15. The system of claim 13 wherein each soft decision trellis decoder is further  
2 adapted to provide a confidence value for each estimate.

1 16. The system of claim 13 wherein each soft decision trellis decoder is further  
2 adapted to infer missing nodes of trellis model from existing nodes based on values of the  
3 one or more detected hopped features, and to correct for burst errors.

1 17. The system of claim 11 wherein the interference cancellation and re-  
2 decoding module includes:

3 one or more multiuser detectors for removing the estimated contributions of the  
4 interfering other-user differential M-ary signals for each user; and  
5 a corresponding soft decision trellis decoder operatively coupled to each multiuser  
6 detector, for re-decoding the ambiguous data estimates remaining in the  
7 interference-cancelled signal.

1 18. The system of claim 11 further comprising:

2 an iteration controller operatively coupled to the interference cancellation and re-  
3 decoding module, and adapted to provide the re-decoded data estimates for  
4 further processing by the interference cancellation and re-decoding module  
5 when appropriate, based on an iteration rule;

6 wherein in response to determining that iteration is not likely to improve the quality  
7 of the re-decoded data estimates, the iteration controller provides the re-  
8 decoded data estimates as final decoded data.

1 19. A method for receiving in a multiuser communication environment a co-  
2 channel signal including a target-user differential M-ary signal and one or more interfering  
3 other-user differential M-ary signals, the method comprising:

4 decoding the co-channel signal based on a hopped feature associated with the co-  
5 channel signal, thereby providing soft-decision estimates of data bits  
6 included in the co-channel signal for each user;

7 removing estimated contributions of the interfering other-user differential M-ary  
8 signals using multiuser detection (MUD), thereby providing an interference-  
9 cancelled signal; and

10 re-decoding ambiguous data estimates remaining in the interference-cancelled  
11 signal.

1 20. The method of claim 19 wherein the hopped feature is at least one of  
2 frequency, time, phase, amplitude, code, duty cycle, polarity, dwell time, and basis  
3 function.

1 21. The method of claim 19 further comprising:  
2 repeating the removing and re-decoding one or more times.

1 22. The method of claim 19 further comprising:  
2 providing the re-decoded data estimates as final decoded data.

1 23. The method of claim 19 wherein decoding the co-channel signal includes:

2 detecting the hopped feature per a predetermined time interval of the co-channel  
3 signal;  
4 constructing a trellis model for each user using values of the detected hopped  
5 feature as nodes; and  
6 determining soft-decision estimates of data bits included in the co-channel signal  
7 for each user, using the corresponding trellis model.